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ASSESSMENT OF RELATION BETWEEN PHYSICAL STRESS AND PHYSICALFITNESS USING TREADMILL IN FEMALE ADULTS

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ABSTRACT

Physical fitness is the potential capacity of an individual for making adequate functional adjustments to increase metabolic demands. One obvious approach to evaluate physical fitness is the physical work capacity of an individual. It can be influence by age, sex, body size etc. The study was carried out on 30 female college going postgraduate students. Physical work capacity measured basing on activity time by using treadmill test. During treadmill test L5 and L6 load exercises correlated to Hb level and activity time, total energy expenditure with activity time, negative correlation was observed between heart rate recovery time and Lean Body Mass and no significance difference was observed in Pulse Pressure.

KEYWORDS: Physical Fitness, Haemoglobin (Hb), Blood Pressure (B. P.), Lean Body Mass (LBM), Basal Metabolic Rate (BMR), Body Mass Index (BMI), Total Energy Expenditure (TEE), Pulse Pressure, Activity Time (AT) Tread Mill Test

INTRODUCTION

Physical fitness is a general state of health and well-being and, more specifically, the ability to perform aspects of sports or occupations. Physical fitness is generally achieved through correct nutrition, (Tremblay, 2010) moderate-vigorous physical activity, (De groot, 2010) exercise and rest, (Malina, 2010). It is a set of attributes or characteristics seen in people and which relate to the ability to perform a given set of physical activities.

Physical stress and physical fitness has been called a global epidemic by the World Health Organization (world health organization, 2000). The prevalence of physical stress and physical fitness is especially dramatic in economically developed and developing countries (Wang and Lobstein, 2006) and not only in adults but also in children and adolescents.

For instance, physical stress in adults and adolescents are more likely to suffer from cardiovascular, metabolic, pulmonary, psychosocial disorders. Even if these conditions or disorders are not manifested during childhood, being physical stress in adolescents increases the risk of illness in adulthood (Daniels, 2006). Hence, it is critical to identify risk factors for physical stress and fitness in adults and adolescents.

The heritability of predisposition for a high body mass index (BMI) or body fat content is between 25 and 40% (Bouchard et al., 1997), which suggests that other factors such as environmental factors may also play a critical role.

According to Bouchard et al., (1997) both the family environment and genetic predisposition influence the development of body fat content and distribution. Other important factors include lifestyle factors such as physical activity (PA), nonsmoking, high-quality diet, sedentary activities and normal weight (Pronk etal, 2004) Lifestyle factors are also important in the description of the obesogenic environment that is based on the four pillars family, sport and leisure time, eating behavior and social education (wabitsch, 2004).

The purpose of this study was to evaluate the relationship between physical stress and physical fitness in relation to different parameters

MATERIALS AND METHODS

In the present study 30 female post graduate and PhD students were selected from Acharya N.G.Ranga Agricultural University. And all the subjects were in the age group of 20 to 30 years. The data collected on Socio Economic status of selected subjects was assessed through a structured schedule developed by Thimmayamma et al (1987). Body composition such as total body fat (BF), lean body mass (LBM) and total body water (BW). BMI and Basal metabolic rate (BMR) were measured using body composition measuring equipment "Bioelectrical Impedance" named as "Body stat. The heart rates were monitored on a online polar heart monitor throughout the exercise period and recovery time. Physical fitness was tested in lab conditions with the help of Graded maximal exercise test (GXT) under laboratory conditions using the standard Bruce protocol on the treadmill to identify maximal performance of an individual The parameters studied are Heart Rate, B.P., Pulse, Energy Expenditure and Body composition such as total body fat (BF), lean body mass (LBM) and total body water (BW) Body Mass Index and Basal Metabolic Rate based on activity time. All the data was expressed through mean and standard deviation. Significance changes in each parameter during treadmill test was assessed through F-test, multiple correlations and multiple regressions.

RESULTS AND DISCUSSIONS

Family Particulars of Subjects

Information pertaining to family background of selected subjects was analyzed and presented in table 1

Table 1: Family Particulars of Selected Subjects

Family Particulars	No	Per cent
Type of Family :		
Nuclear	30	100
Joint	0	-
Size of the Family		
Below 3	4	13
4-5	19	63
Above 6	7	24
No. of Male Members in a Family		
Below 2	20	67
3-4	9	30
Above 5	1	3
No. of Female Members in a Family		
1	6	20
2	11	37
3	8	27
4	4	13
5	1	3
Marital Status of Subjects		

Table 1: Contd.,		
Married	4	13
Unmarried	26	87
Educational Status		
P.G	26	87
PhD	4	13
Family Income Per Annum (Rs)		
75,000-1,00,000	5	17
1.00,000-1,50,000	6	20
1,50,000-2,00,000	9	30
2,00,000-2,50,000	5	17
2,50,000-3,00,000	5	16

All the subjects were from nuclear family (100 per cent) and majority had four (33 per cent) or five (30 per cent) members in family with maximum two male (40 per cent) and two female (37 per cent) members. Most of the subjects were unmarried (87 per cent) and doing post graduation (87 per cent). Family income of subjects ranged mostly (30 per cent) between one and half to two lakhs. This was followed by one to one and half lakh (20 per cent). The major reasons could be due to regular, private or government jobs of earning members in the respondent families.

Grouping of Subjects as per Activity Time in Treadmill Test

Table 2: Grouping of Subjects as Per Activity Time in Treadmill Test

Time Ranges (Mt)	**Subjects**		
Treadmill Ranges:	***No***	***Per Cent***	***Mean ± Sd***
10 -12	16	53	11.3 ± 0.78
>12 - 14	7	23	13.1 ± 0.27
>14 - 16	5	17	14.9 ± 0.20
>16 - 18	2	7	16.5 ± 0.50

The subjects were grouped as per activity time of treadmill test.

The AT for majority (53 per cent) was 10 to 12 mt followed by >12 to 14 mt (23 per cent), >14 to 16 mt (17 per cent) and least (7 per cent) had > 16 to 18 mt, during treadmill test (Table 2).

Changes in Parameters during Treadmill Test

The activity time is grouped into 4 periods that is 10 to 12 mt, >12 to 14 mt, >14to 16mt and >16 to 18. (Table 3).

Table 3: Changes in Parameters of Subjects during Treadmill Test, Basing on Activity Time

Parameters	**Activity Time Ranges (mt)**				**Correlation**	**Regression**
	10 – 12 (16)	**>12 – 14 (7)**	**>14 – 16 (5)**	**>16 – 18 (2)**		
Heart rates during Workloads (bpm)						
Rest	82 ± 7.65	77 ± 3.14	76 ± 8.16	81	-0.1797	0.491
L1	127 ± 17.18	117 ± 6.43	124 ± 8.03	113	-0.1345	0.693
L2	134 ± 11.81	124 ± 9.34	139 ± 6.85	123 ± 8.00	-0.0754	-0.598
L3	153 ± 12.4	144 ± 6.54	153 ± 8.52	142 ± 10.5	-0.1803	-0.678
L4	178 ± 7.26	170 ± 8.85	178 ± 7.73	164 ± 8.50	-0.2705	0.64
L5	-	183 ± 8.27	193 ± 6.49	187 ± 0.50	0.8244**	1.344
L6	-	-	196 ± 0.00	197 ± 0.50	0.6510**	-1.277
AT	11 ± 0.78	13 ± 0.27	15 ± 0.20	17 ± 0.50	-	-
TEE	60 ± 6.15	77 ± 3.46	97 ± 4.24	112 ± 3.00	0.9800**	9.149**
Heart Rate (bpm) Recovery Time (mt)						
15	108 ± 6.52	108 ± 7.90	-	-	-0.6575**	0.83

Table 3: Contd.,						
20	110	95 ± 0.30	111 ± 9.11	111 ± 1.00	0.5447**	0.759
25	-	105 ± 0.00	107 ± 1.90	-	0.289	0.491
B.P Systolic (mm Hg)						
Table 3: Contd.,						
Before	106 ± 6.88	107 ± 6.77	108 ± 7.17	114 ± 1.5	0.1644	-0.964
After	126 ±11.3	127 ± 71.4	133 ± 3.40	129 ± 5.50	0.2364	-0.438
B.P Diastolic (mm Hg)						
Before	70 ± 4.38	72 ± 4.94	74 ± 9.76	70 ± 0.50	0.93	-0.362
After	73 ± 7.67	72 ± 8.33	80 ± 8.11	74 ± 2.00	0.2293	-0.078
Pulse Rate (bpm)						
Before	78 ± 19.67	85 ± 11.3	81 ± 5.27	74 ± 2.00	0.1666	-0.099
After	118 ± 9.13	126 ± 13.4	143 ± 3.07	134 ± 13.5	0.6126**	0.905
BMR (K.cal / 24Hr)	1272 ± 110	1295 ± 62.5	1356 ± 113.6	1472 ± 93.3	0.3852*	-
BMI	21 ± 3.69	21 ± 2.98	21 ± 1.42	23 ± 0.35	-0.0246	-
Bodycomposition (Per Cent)						
LBM	70 ± 4.25	72 ± 4.5	74 ± 3.6	74 ± 2.4	-0.3747*	-
Fat	30 ± 4.95	28 ± 4.4	26 ± 2.5	26 ± 2.4	0.4614*	-
Body water	52 ± 4.2	53 ± 3.37	53 ± 3.2	52.8 ± 0.7	0.1667	-
Hb (g/dl)	10 ± 1.6	12 ± 1.45	13 ± 1.08	14 ± 0.00	0.6825**	-
F =37.54552**		*** Significance at 5%,**		**** Significance at 1%**		
L1 to L6 are workloads with 3 mt increase						

During rest period, the heart rates ranged between 76 bpm (> 14 – 16 mt group) and 82 bpm (10 -12 mt group). During load exercises, a trend was observed with decreasing AT (>16 – 18 to 10 -12 mt), an increase in heart rate (164 to 178 bpm) was observed. Negative insignificant correlation was observed up to L4 work load test and after that positive significant (5%) correlation was observed between heart rate and AT.

When AT was between >14 – 16 mt, great variation was observed in heart rates during different work loads. Maximum number (16) of subjects fell into 10 – 12 mt group followed by >12 to14 mt (7), >14 – 16 mt (5) and least (2) in higher AT group i.e. >16 to 18 The group who could perform activity for to 10 – 12 mt, discontinued exercise after L4 level. While > 14 -16 and >16 to 18 mt at L6 level. The mean AT ranged from 11 mt to (10 to12 mt AT group) to 17 mt.

The total energy expenditure showed a perfect positive trend with AT it has increased from 60 K.Cal (10 -12 mt AT) to 112 K.Cal (16 to 18 mt AT). Highly significant (1 per cent) positive correlation and regression was observed between total energy expenditure and AT.

Heart rate recovery was also assessed and found that the recovery period ranged between 15 to 25 mt. The lowest and highest AT group recovered in 20 mt while the rest two groups in 25 mt. Correlation was observed between 15 mt recovery time as well as 20 mt recovery times and AT.

The initial systolic B. P was similar among all the groups except in > 16 to 18 group following load test the group falling into > 14 -16 mt group had highest (133 mm Hg) systolic and diastolic (80 mm Hg) B. P. While diastolic B. P showed fluctuations with increased AT. The diastolic B. P increased slightly in all the groups and increase was highest in >14 to 16 mt (80 mm Hg) AT group. The pulse rate initially ranged between 74 bpm (>16 -18 mt AT group) to 85 bpm (>12 – 14 mt AT group). This has increased following load exercise and the increase was highest (143 bpm) in 14 -16 mt AT group. The pulse rate before exercise showed no significance but after exercise highly significant (1 per cent) correlation was observed between pulse rates and AT.

The BMR which was recorded initially, increased with increase in AT. For lower AT group (10 – 12 mt) lower BMR (1272 K.Cal / 24 Hr) and high AT (>16 – 18) group had high BMR (1472 K. Cal / 24 Hr). Significant (5 per cent) positive correlation was observed between AT and BMR.

BMI of all the groups was similar (21) except for high AT (>16 – 18 mt) group (23).

The LBM showed a proportional relationship with AT. The LBM increased from 67 per cent (10 – 12 mt group) to 74 per cent (>16 – 18 mt group). Significant (5 per cent) correlation was observed between LBM and AT. The body fat content decreased with increase in AT except for high (>16 – 18 mt group) AT group. The fat per cent ranged between 23 (>14 – 16 mt group) and 30 (10-12 mt group) and significant positive correlation (5 per cent) was observed betweens AT and fat content. Body water remained same in all groups when classified basing on AT.

The lowest group had 10 g/dl while > 16 to 18 mt group had highest Hb level (14 g/dl). High positive significance (1 per cent) was observed between Hb levels and AT.

The 'F' value showed high significance (1 per cent) for AT.

Total Energy Expenditure

The energy expenditure during different work loads (Table 4) increased from initial 7 to 9 calories (100 per cent) to 60 to 70 calories (83 per cent). Majority of subjects (83 per cent) could stand for a speed of 6.4 kmph and negligible (13 per cent) could continue up to 8.9 kmph with energy expenditure of 100-110 K.Cal and 120 to 130 K.Cal for the activity. Most (83 per cent) of the subjects discontinued activity after L4 in 51 to 70 range followed by L5 load with 75 to 85 energy expenditure and few (7 per cent) were terminated at L4 level with energy expenditure of 51 to 60. All the rest of subjects discontinued at L5 with energy range of 86 to 95 (20 per cent) or L6 with 100-110 range (10 per cent) or 121-130 range (3 per cent) energy spent.

Table 4: Energy Expenditure of Subjects, During Different Workloads, in Treadmill Test

Work Loads	Energy Expenditure (K. Cal)	No	Per cent	Mean ± SD
L1	7-9	30	100	8 ± 0.18
L2	20-21	4	13	21
	21 -22	26	87	22
L3	30-40	7	23	39 ± 3.36
	40-50	23	77	41 ± 0.21
L4	40-50	3	10	50 ± 0.58
	50-60	2	7	55 ± 3.54
	60-70	25	83	64 ± 1.17
L5	75-85	7	23	78 ± 4
	85-95	6	20	93 ± 1.38
L6	100-110	3	10	102 ± 2.08
	110-120	0	0	-
	120-130	1	3	126 ± 0.00

Changes in parameters during treadmill test basing on total energy expenditure was assessed and tabulated in Table 4.

Basing on load of the exercise, body size, training of participant etc influence energy expenditure. Subjects were given a package consisting of six load exercises and each load exercise was for a fixed period of 3 minutes.

Energy expenditure increased with increase in activity except in the case of L4 load exercise. Under each load, the subjects were further grouped basing on energy expenditure of When subjects were exposed to L1 load test a mean energy expenditure 8 K Cal was observed. On continuing L2 load exercise, majority (87 per cent) of subjects TEE was 22 K.cal and few (13 per cent) spent 21 K.cal. On subjecting to L3 load, majority (77 per cent) of subjects fell into higher (41 K.cal) energy expenditure group. When subjects further continued load i.e.; at L4 (83 per cent) a mean energy expenditure of 64 K.cal was observed which higher range at that particular load is. Equal number of subjects, at L5 load had TEE of 78 K.cal (23 per cent) and 93 K.cal (20 per cent). Very few (13 per cent) subjects remained up to L6 load and majority of them had TEE of 102 K.cal (10 per cent).

From the above Table 4 it is clear that the subjects spent varying for same load test energy load but majority of the subjects fell into the higher range energy expenditure. Under each load test, few subjects' energy expenditure was on the lower side for the same activity. The variation in energy expenditure could be considered due to differences in body size, age, hereditary differences etc.

CONCLUSIONS

The physical performance was analyzed through treadmill test. Among all the exercises during treadmill test L5, L6 load exercises correlated to Hb and AT indicating relationship between the parameters. No correlation was observed between parameters followed by resting 15 to 20 mt. Recovery time correlated to BMI (1 per cent), Hb (1 per cent),. AT (1 per cent), BMR (5 per cent) and LBM (5 per cent).

PFI analysis revealed poor performance by all the subjects. This can be evinced poor food and nutrient intake.

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